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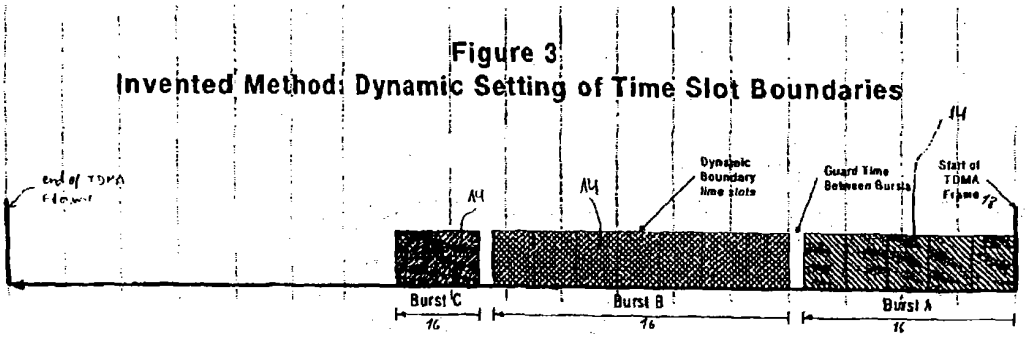
(54) Method for dynamic bandwidth allocation and fast setup method for airlink protocols

(57) A method for implementation of a time saving air protocol for a system including a base station and remote terminal stations connected by an downlink channel from the base station to the remote terminal station, and by an uplink channel from the remote terminal station to the base station, the method featuring the step of sending a frame of information, from the remote terminal station to the base station on the uplink channel, said frame being a continuous transmission of a plurality of dynamically formatted bursts, each burst including a plurality of dynamically numbered adjacent time slots, such that said time slot boundaries are substantially congruent and such that a guard time is present only between bursts.

Figure 3
Invented Method: Dynamic Setting of Time Slot Boundaries



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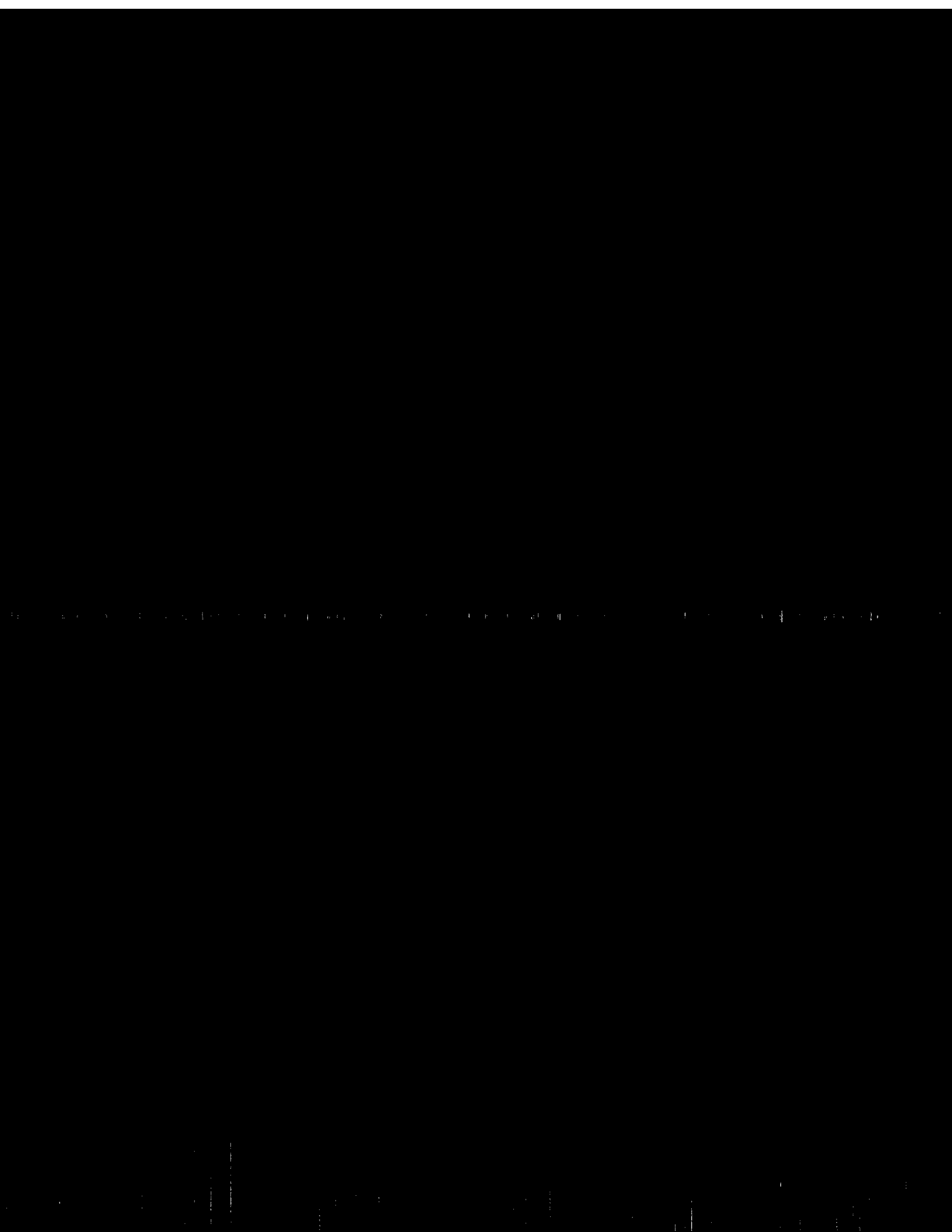

within a fixed boundary of frame **18**, and cannot be changed.

[0014] Compared with the prior art, the invented protocol (as shown in Figure 4) provides for much more flexibility. The following invented method is used: First, each burst **16** includes an integral number of time slots **14**. Each burst **16** is dynamically timed at a specific point within uplink frame **18**. Timing bursts **16** and time slots **14** within burst **16** are not limited to a fixed boundary time slot **14**, but instead are dynamically changeable. Changes to burst **16**, in size and in timing can be made using resolution of only a single signal.

[0015] This method is used on each radio wave frequency **20** (see Figure 4). Frequency f1 **20** is used for information transfer between first group **22** of stations that includes base station **10** and terminal stations **12**. Frequency f2 **20** is used for information transfer between second group **24** of stations that includes base station **10** and terminal stations **40**.

[0016] Burst timing control is performed as follows: base station **10** is responsible for timing and length of each terminal station **12** uplink burst **16**. Allocated terminal station burst **16** length is changed in view of the bandwidth requirements. The ability of burst **16** to change depends not only on the needs of a specific terminal station **12**, but rather on needs of other terminal stations **12** as well.

[0017] The invented method includes a control system. This control system includes the use of a polling mechanism to prevent possible collisions between terminal stations **12**. Collisions occur when a simultaneous transmission is made by more then one terminal station. The system also has a short communication link setup time. Communication setup time is required to set up a communication link between base station **10** and a terminal station **12**. Prior art protocols, which use polling algorithms, waste time when performing communication link setup process, due to the search for a new terminal station **12**. A new terminal station **12** needs to spend a significant amount of time, in each communication link, waiting for base station **10** to address it. This waiting time is called the polling interval.

[0018] The invented method reduces the amount of time that terminal station **12** wastes while waiting to be addressed by base station **10**. In each frame of every communication downlink, base station **10** transmits the number of terminal stations **12** that have not yet established communication link with base station **10**. Pre definition of existing terminal stations **12** is provided to base station **10** by system's operator. Periodically, base station **10** sends a search terminal station message to all the unregistered terminal stations **12**. The search message is part of the polling process. The search terminal station message includes terminal station **12** user ID number.

[0019] Terminal station **12** scans all available channels in frequency domain **20**. While searching, terminal station **12** compares the received scanned signal against a pre- defined threshold. The pre- defined threshold is the minimal signal level transmitted by base station **10**. If received signal is above the pre-defined threshold, then terminal station **12** will try to start synchronize on the received signal. If received signal is below the pre- defined threshold, or if synchronization fails, then terminal station **12** continues the frequency scan in frequency domain **20** in a cyclic manner.

[0020] When synchronized, terminal station **12** first checks if base station **10** is searching, on the uplink channel, for a number of new terminal stations **12**. If base station **10** does not search for any new terminal stations **12**, then terminal station **12** will continue the frequency scan on the uplink channel. If, on the other hand, base station **10** is searching for any positive number of new terminal stations **12**, then terminal station **12** listens to the downlink channel for a period of the polling interval. While listening, terminal station **12** waits for a search terminal station message which contains the proper ID number. If no such search message is received within the polling interval, then terminal station **12** continues the frequency scan in frequency domain **20** in a cyclic manner. If terminal station **12** receives a message that includes the specific ID number, then the polling process ends and terminal station **12** establishes a communication link with base station **10**.

[0021] While the invention has been described with respect to limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made.

Claims

1. A method for implementation of a time saving air protocol for a system including a base station and remote terminal stations connected by an downlink channel from the base station to the remote terminal station, and by an uplink channel from the remote terminal station to the base station, the method comprising the step of:

   (a) sending a frame of information, from the remote terminal station to the base station on the uplink channel, said frame being a continuous transmission of a plurality of dynamically formatted bursts, each burst including a plurality of dynamically numbered adjacent time slots, such that said time slot boundaries are substantially congruent and such that a guard time is present only between bursts.

2. The method of claim 1 further comprising the steps of:

   (b) sending from the base station to the remote terminal station information on the downlink channel, and;

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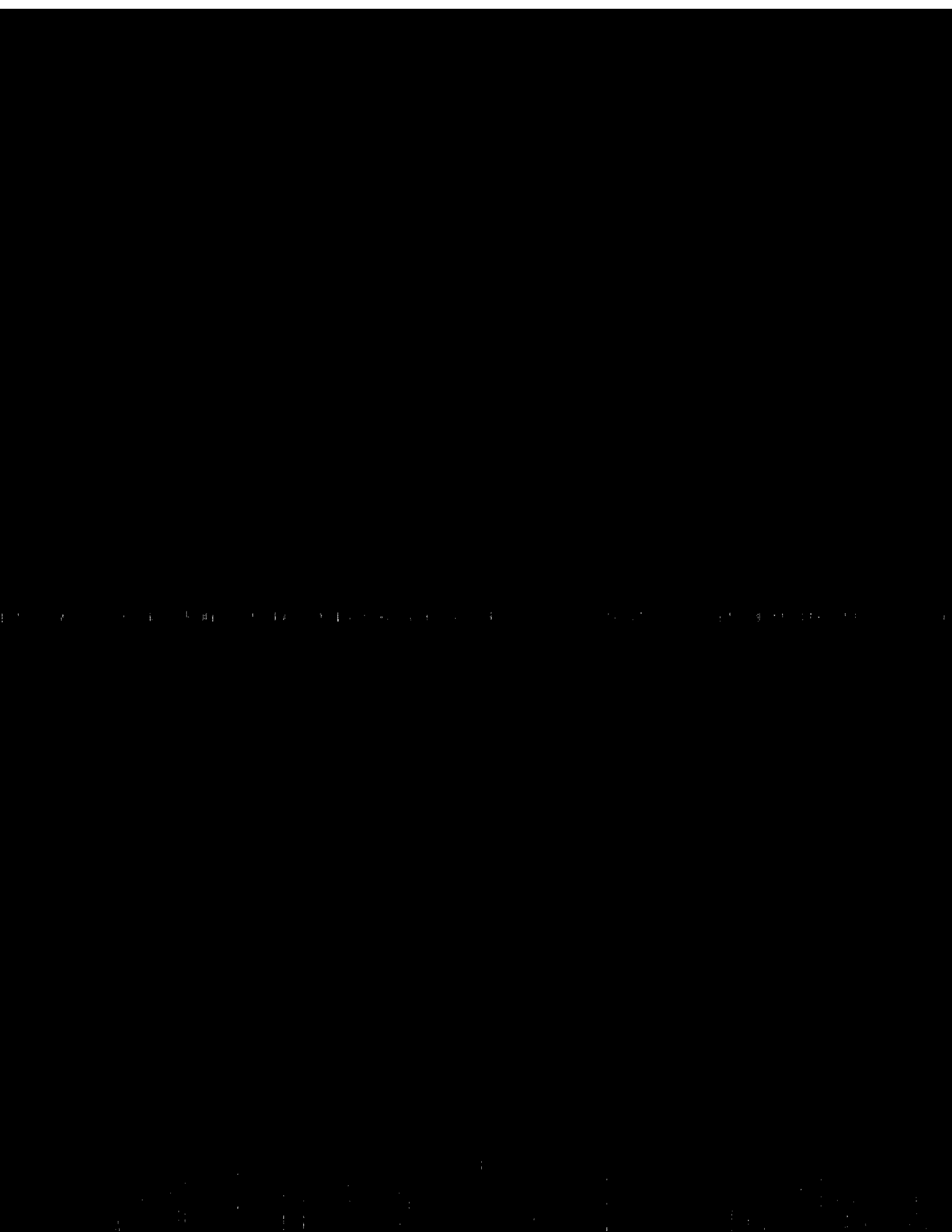

Typical Local Loop System: Base Station and Terminal Stations

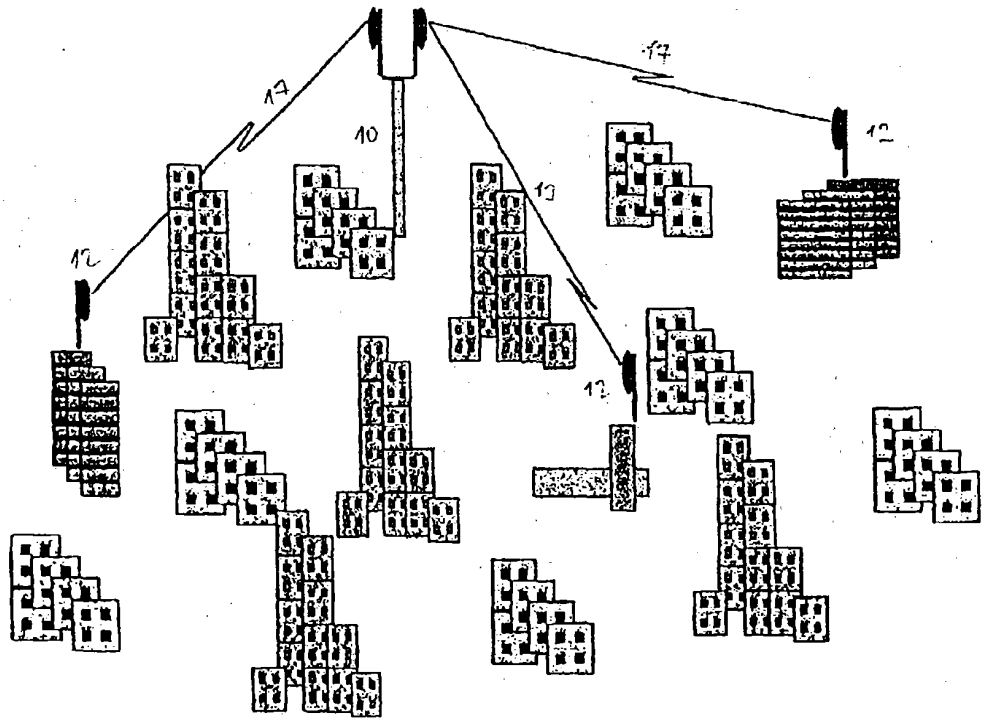

FIG. 1

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TDMA Structure:
Dynamically Allocated Bursts

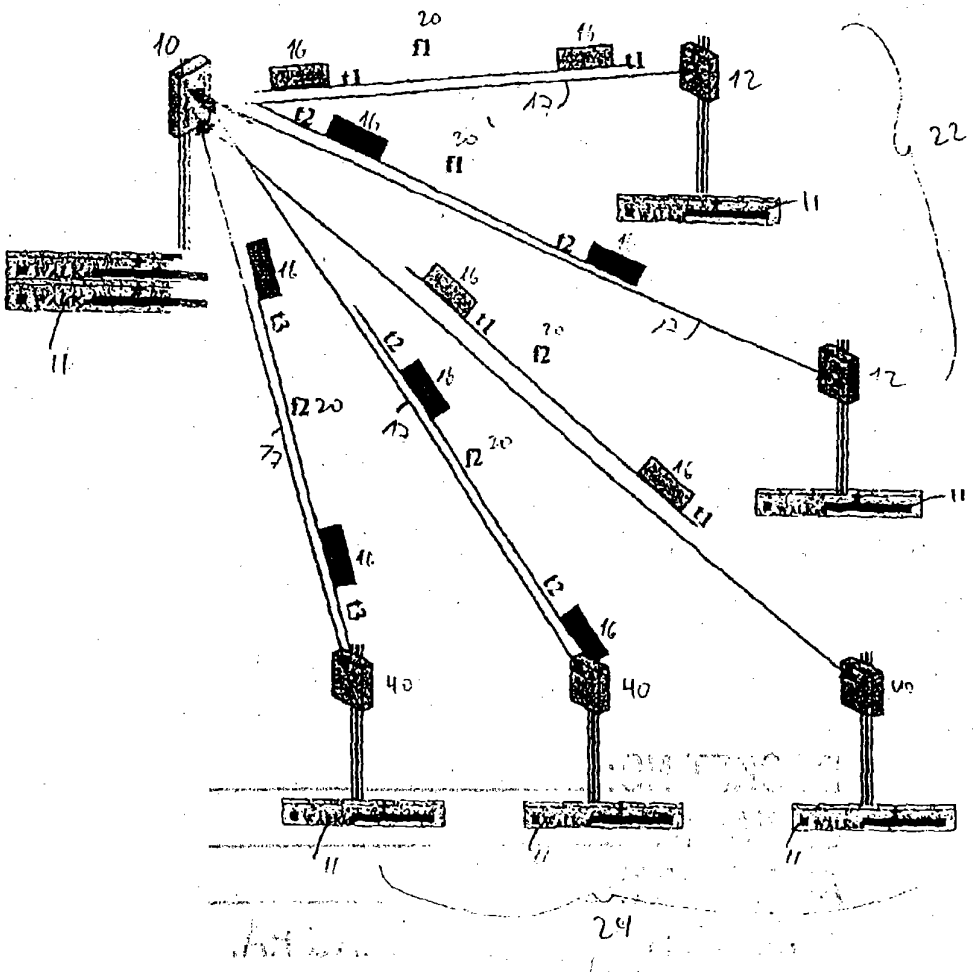
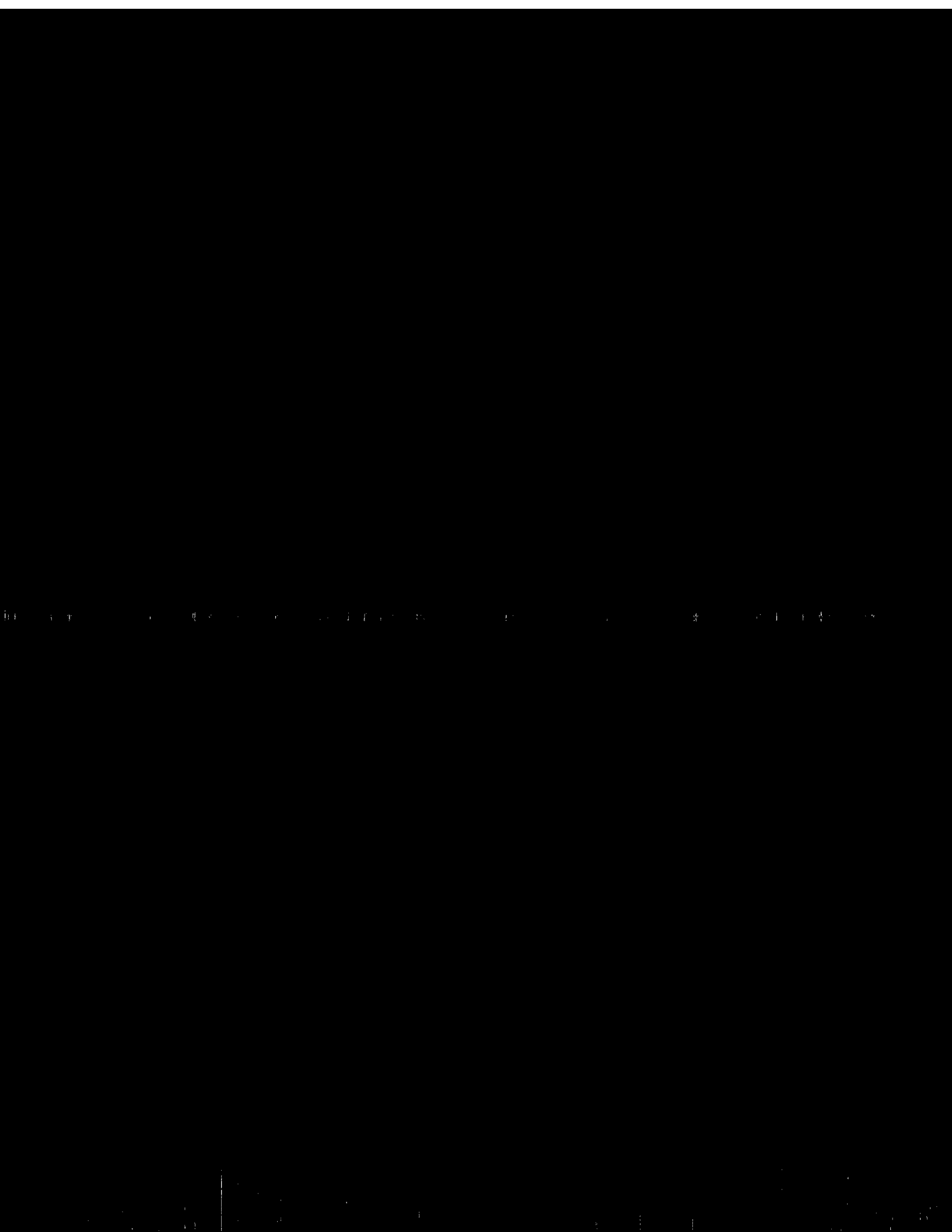


FIG. 4

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